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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/582,271	06/09/2006	Didier Marsacq	128259	4808
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EXAMINER CHUANG, ALEXANDER				
ART UNIT		PAPER NUMBER		
4128				
MAIL DATE		DELIVERY MODE		
12/07/2007		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

**Application No.**

10/582,271

**Applicant(s)**

MARSACQ ET AL.

**Examiner**

Alexander Chuang

**Art Unit**

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 9 June 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 11-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 11-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SI/02)  
Paper No(s)/Mail Date 6/9/2006
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Summary***

1. Claims 11-20 are pending.
2. Claims 1-10 were canceled on 6/9/2006.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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5. Claim 11-13, and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tada et al (JP 09-245802) in view of Herman et al (*J. Membrane Science* 218 (2003) 147-163).

Regarding claim 11, TADA et al teaches a typical polymer electrolyte fuel cell in Figure 1. This system consist of a polymer electrolyte membrane 1 sandwiched by catalyst layers 2A (anode) and 2C (cathode). There exist an intermediate catalyst layer 3A and 3C, which is sandwiched by, layers 2A and 2C and the gas feed holes (gas channels) 5A and 5C. Additionally, TADA et al goes into detail about the multiple catalyst layers (2A/2A or 3A/3C) in Figure 2, which is required in **claim 18 and 20** of this invention. Figure 2 depicts a multiple catalyst layers comprising of catalyst particles (14) and catalyst support (15) sandwiched between the membrane (11) and the gas diffusion layer (13). **See also abstract and paragraph 10.** TADA et al was silent about the nature of the anion exchange membrane. Herman et al disclose the use of the benzytrimethylammonium hydroxide alkaline anion-exchange membrane analogue. **See scheme 1 on page 149.** This polymer has vinylaromatic properties as well as a quaternary ammonium functional group. On **page 161**, the conductivity of the polymer was  $0.01 \text{ S cm}^{-1}$  as required in **claim 19**. Both references are analogous art since both are within the same field of endeavor: improving fuel cell performance by using a high performance ion exchange membrane. Because Tada et al teaches a polymer electrolyte membrane fuel cell and Herman et al teaches a conductive polymer, it would have been obvious to one skilled in the art to substitute the existing polymer membrane of Tada et al

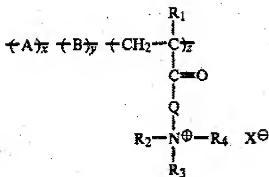
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with Herman et al's in order to achieve the predictable result of creating a working fuel cell.

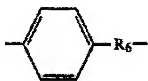
Regarding claims 12-13, the polymer stated previously and used in Herman et al's studies has a styrene main chain. **Please see scheme 1 on page 149.** The aromatic group of the styrene main chain has a quaternary ammonium functional group with a hydroxide counter ion.  $X_1$ ,  $X_2$ , and  $X_3$  are hydrogen atoms and all the R groups are alkyl groups.

6. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tada et al (JP 09-245802) in view of Herman et al (*J. Membrane Science* 218 (2003) 147-163) as applied to claim 11-13 and 17-20 above, and further in view of Yokoyama et al (US 4374924).

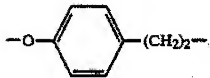
Tada et al and Herman et al disclosed a fuel cell as discussed previously. Both references were silent about the chemical composition of electronic conductive element.



Yokoyama et al disclosed the polymer depicted above, **located in the abstract and the bottom of column 2**, for the use of creating a photographic light-sensitive material. Yokoyama et al defined  $R_1$  as a hydrogen atom or an alkyl group, Q represents a divalent group,  $R_2$ ,  $R_3$ , and  $R_4$  may be the same or different groups representing an alkyl group. On column 4, Yokoyama et al discloses two examples of the Q group; one is shown below.



Yokoyama et al defined  $R_6$  as an alkylene group containing 1-6 carbons. Examples are shown in the middle column 4; one is shown below.



Putting these three pieces yields the general structure formula (II) as disclosed in claim 14 of the current invention. The ethylene backbone has a carbonyl substituent which is  $R'$  of claim 14. The Q and  $R_6$  combination meets the specifications of Ar and R groups of general structure formula (II) of claim 14.  $R_2$ ,  $R_3$ , and  $R_4$  are equivalent to  $R_1$ ,  $R_2$ , and  $R_3$  of the current invention. Finally, the counterion  $X^-$  can be represented by the hydroxide ion of general structure formula (II).

Since Herman et al disclosed a polymer with quaternary ammonium functional groups in an attempt to optimized fuel cell performance and Yokoyama et al

disclosed more of the same type of polymer and taught method of synthesis of these polymers, it would have been obvious to a person having ordinary skill in the art to synthesize and use polymers with quaternary ammonium substituent in an alkali fuel cell in order to improve fuel cell performance.

7. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tada et al (JP 09-245802) in view of Herman et al (*J. Membrane Science* 218 (2003) 147-163) as applied to claims 11-13 and 17-20 above, and further in view of Hou et al (US 6468657).

Tada et al and Herman et al disclosed a fuel cell as discussed previously. Both references were silent about the type of electronic conductive element present in the fuel cell. Hou et al disclosed using inert conductive materials such as carbon, platinum, and gold. These inert conductive materials do not undergo or participate in electrochemical reactions; therefore, they do not degrade or deplete due to the current, oxidation, and reduction. Additionally, sacrificial materials such as silver may be used in the anode and gold may be used in the cathode. Hou et al defines sacrificial material as a material that is depleted during an electrochemical process. **Please refer to the bottom of column 47 (lines 61-67), all of column 48, and column 49 (lines 1-15).** All references are analogous art since all are within the same field of endeavor: ion-exchange membranes. Thus, it would have been obvious to a person having ordinary skill in the art to incorporate conductive materials, particularly the inert materials, in order to provide conduction of current.

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8. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tada et al (JP 09-245802) in view of Herman et al (*J. Membrane Science* 218 (2003) 147-163) as applied to claims 11-13 and 17-20 above, and further in view of KANEKO et al (US 2003/0054226).

Regarding claim 16, Tada et al used platinum as the catalytic element. See paragraph [0019]. The reference was silent about using silver. Kaneko et al uses silver for the anode catalyst and platinum as the cathode catalyst. See paragraphs [0080] and [0082]. Since both Tada et al and Kaneko et al discloses which metal catalysts are appropriate for use in the electrode catalyst layer, it would have been obvious to one skilled in the art to substitute one catalyst for the other to achieve the predictable result of running a fuel cell process.

9. Claims 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tada et al (JP 09-245802) in view of Herman et al (*J. Membrane Science* 218 (2003) 147-163) as applied to claims 11-13 and 19 above, and further in view of TADA et al (US 6339038).

Tada et al (JP 09-245802) and Herman et al disclosed a fuel cell discussed previously. Both references were silent about the gas diffusion layer and the active layer comprising of the catalyst and the conductive element. TADA et al disclosed the location of the catalyst layer; the catalyst layer, in powder form is situated in between the membrane and the gas diffusion layer. Another work by Tada et al (US 6339038) explained the micropore size distribution on the carbon powder affects catalytic performance. A micropore of a diameter less than 60 Å is too small for a solid electrolyte to enter. Thus, hydrogen produced by the



electrochemical reaction is unable to transfer to the electrolyte, which lowers the efficiency of the catalyst. Please refer to column 3, lines 6-23.

### ***Conclusion***

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alexander Chuang whose telephone number is (571) 270-5122. The examiner can normally be reached on Monday to Thursday 8:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Barbara Gilliam can be reached on (571) 272-1330. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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//Barbara L. Gilliam//

Supervisory Patent Examiner, Art Unit 4128